ALCOHOL AND DRUG ABUSE HOSPITALIZATIONS AMONG SUBMARINE PERSONNEL IN THE U. S. NAVY

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SUMMARY

Problem

Previous Naval Health Research Center studies have found that submarine personnel have lower hospitalization rates than surface-ship personnel. However, because Navy hospitalization admission rates are known to vary by occupation, occupation-specific hospitalization rates for alcohol and drug abuse among submariners were examined to determine the effects of submarine work environments and substance abuse.

Objective

The objective of this study was to determine the alcohol and drug abuse hospitalization rates of submariners within five occupational groups and compare the results with data for surface-ship personnel.

Approach

The Service History file maintained by the Naval Health Research Center in San Diego was searched for all personnel who had served aboard nuclear- and diesel-powered submarines between 1974-1979 (N = 68,475). A random sample of enlisted personnel who had served aboard surface ships of similar crew size as submarines was selected as a control group (N = 77,541). Age-adjusted hospital admission rates for 16 major diagnostic categories were calculated and compared between submarine and surface-ship personnel for five major occupational groups (administrative/clerical, apprentice, blue collar, electronic/technical, and medical). Relative risks were calculated and 95 percent confidence intervals were computed to determine significant differences in hospitalization rates.

Results

Submarine personnel were found to have statistically significantly lower hospitalization rates for alcohol abuse than surface-ship personnel for each of the five occupational groups. The hospitalization rate for alcohol abuse across all occupational groups for submariners was less than one-half the rate for surface-ship personnel. For drug abuse hospitalizations, submarine personnel had a significantly lower rate in the blue collar occupations. The hospitalization rate for drug abuse across all occupational groups for submariners was about one-half of that rate for surface-ship personnel.

Conclusions

When comparing alcohol and drug abuse hospitalization rates between personnel on submarines and those on surface-ships for the five occupational groups, submarine personnel had lower hospitalization rates. Reasons for the lower hospitalization rates among submariners may be the stringent screening process that removes personnel "at risk" for such hospitalizations. Other contributing factors may be the higher level of education among submariners, and the severe penalties for substance abuse in the submarine service.

Alcohol and Drug Abuse Hospitalizations Among Submarine Personnel in the U.S. Navy

INTRODUCTION

Excessive alcohol and drug use is a major problem in our society. The U.S. Navy, being a part of that society, is certainly not exempt. Environmental stress is often blamed as one of the reasons that people in our society turn to alcohol and drugs. One of the most stressful environments in which U.S. Navy personnel can be placed is on a submarine. The U.S. Navy shipboard environment for submarine personnel is quite different from that for surface-ship personnel. Personnel who serve aboard submarines are exposed to extreme environmental challenges. At any given time, several thousand American submariners are sealed in tiny living spaces, exposed to manufactured air and artificial light, and submerged to great depths for periods in excess of 60 days. During this time, their job is to operate an extremely complicated and potentially dangerous machine.

A number of studies have compared the health of submariners with surface-ship personnel (Burr and Palinkas, 1988; Burr and Palinkas, 1987; Tansey, Wilson, and Schaefer, 1979), and have found submariners to have lower total illness rates. Using hospital admissions, Burr and Palinkas (1987) found that submarine personnel had significantly fewer hospital admissions for: accidents, poisonings, and violence, mental disorders, diseases of the genitourinary system, diseases of the skin and subcutaneous tissue, and diseases of the musculoskeletal system. Among more specific diagnoses, submariners were significantly lower in hospitalizations for viral hepatitis, alcohol abuse, drug abuse, personality disorders, fractures, concussions, contusions, and open wounds.

Certain occupations have been associated with higher rates of illness (Gunderson and Colcord, 1982) and with higher rates of substance abuse (Schuckit and Gunderson, 1974) than other occupations. For example, Schuckit and Gunderson (1974) found higher alcohol-related hospitalization rates in U.S. Navy clerical, deck, and construction groups, and lower rates in technical jobs such as radarmen and communications technicians. Occupational differences in submariner and surface-ship personnel may account for observed differences in hospitalization rates. Occupational groups for this study

were based on similarity of assigned tasks and work environment (see Appendix 1) and included administrative/clerical, blue collar, electronic/technical, medical, and apprentice personnel (Palinkas and Colcord, 1985). The objective of this study was to compare the alcohol and drug abuse hospitalization rates of submariners with those of surface-ship personnel for these five occupational groups.

METHOD

The Naval Health Research Center in San Diego, California, maintains computerized Service History and Medical Inpatient files for active duty naval enlisted personnel. The Service History file was searched for all personnel who had served aboard nuclear- and diesel-powered submarines during the period 1974-1979. A control group, consisting of a random sample (approximately 50%) of enlisted personnel who had served aboard surface-ships of approximately the same crew size as submarines, and during the same period of time, also were identified from the Service History file. Only white males were selected because of the small number of personnel represented in other groups (e.g., female, black, Hispanic), and to control for the potential confounding influence of sex and race on hospital admission rates. Ship types represented in the surface-ship group included Destroyer, Guided Missile Destroyer, Frigate, and Guided Missile Frigate.

Diagnoses were in accordance with the International Classification of Disease Adapted for Use in the United States, Eighth Revision. Hospitalizations for these samples reflected data for deployed ships as well as ships in port; rates were expressed as the number of hospital admissions per 100,000 person-years.

Age-adjusted hospital admission rates were calculated using the direct method of adjustment (Lilienfeld and Lilienfeld, 1980). The age-adjustment procedure was used to derive an overall rate based on the age distribution of the Navy's ship-board population. This was accomplished by using a standard population created by summing the submariner and surface-ship comparison groups, and then using occupation-specific rates to compute the expected number of hospitalizations for each group within the standard population. The age-adjusted rates for submariners and surface-ship occupational groups were compared using relative risks. The relative risk was computed by dividing the submariner hospitalization rate for an occupational group by the

surface-ship hospitalization rate for that occupational group. This computation gives a measure of the likelihood, relative to the surface ship group, that a member of the submariner group will acquire a certain disease. Ninety-five percent confidence intervals were used to assess statistical significance of observed differences in hospitalization rates by occupational group (Lilienfled and Lilienfeld, 1980). It should be noted, however, that although multiple comparisons are examined, no adjustment to the confidence intervals was made.

RESULTS

The search of the Service History file identified 68,475 submarine personnel and 77,541 surface-ship controls. Table 1 shows the numbers and percentages of submarine and surface-ship personnel for each of the five occupational groups. Blue collar occupations accounted for nearly one-half of the personnel in both the submarine and in the surface-ship group; percentages of personnel in the other occupational groups were generally comparable between submarines and surface-ships. The number of enlisted white males across all occupational groups for submarine personnel during this period averaged 43,541 per year, and the number of enlisted white males for surface-ship personnel averaged 45,151 per year.

Table 1. Number and Percent of Submarine Personnel and Surface-Ship Personnel by Occupational Group

Occupational Group	Submarine		Surface-Ship	
	N	Percent	N	Percent
Administrative/ Clerical	6,516	9.5	8,259	10.6
Blue Collar	31,759	46.4	33,140	42.7
Electronic/ Technical	24,368	35.6	23,110	29.8
Medical	1,075	1.6	997	1.3
Apprentice	3,758	5.5	10,047	13.0
Other	999	1.4	1,988	2.6
Total	68,475	100.0	77,541	100.0

Alcohol and drug abuse diagnoses fall within the ICDA-8 diagnostic category of mental disorders. Across all occupations, submariners had a total of 1859 hospitalizations for this diagnostic category, of which 733 (39%) were alcohol and/or drug related. Surface-ship personnel had a total of 3,364 mental disorder hospitalizations, of which 1,860 (55%) were alcohol and/or drug related.

Table 2 shows mean age at the time of the first hospitalization for alcohol abuse by occupational group for both submarine and surface-ship personnel. Submarine apprentice personnel had the lowest mean age at first hospitalization; submarine medical personnel had the highest mean age at first hospitalization.

Table 2. Mean Age at First Hospitalization for Alcohol Abuse, Submarine Personnel and Surface-Ship Personnel by Occupational Group

	Submarine			Surface-Ship		
Occupational Group	N	Mean Age	Std Dev	N	Mean Age	Std Dev
Administrative/ Clerical	70	26.8	6.6	171	29.3	6.7
Blue Collar	218	28.2	6.2	591	27.4	6.1
Electronic/ Technical	152	28.7	6.5	261	28.2	6.5
Medical	19	30.5	5.2	40	28.0	6.8
Apprentice	69	20.5	3.1	341	21.4	3.6
Total	528	27.2	6.6	1404	26.3	6.4

Table 3 shows mean age at the time of the first hospitalization for drug abuse by occupational group for submarine and surface-ship personnel. Again, submarine apprentice personnel had the lowest mean age at first hospitalization; surface-ship electronic/technical personnel had the highest mean age at first hospitalization.

Table 3. Mean Age at First Hospitalization for Drug Abuse, Submarine Personnel and Surface-Ship Personnel by Occupational Group

	Submarine			Surface-Ship		
Occupational Group	N	Mean Age	Std Dev	N	Mean Age	Std Dev
Administrative/ Clerical	11	20.5	2.3	15	22.1	4.0
Blue Collar	26	22.8	4.3	48	20.8	3.5
Electronic/ Technical	22	21.5	2.2	21	22.9	5.6
Medical	2	22.0	0.0	-	-	-
Apprentice	36	19.9	1.6	115	20.0	2.1
Total	97	21.2	3.0	199	20.7	3.3

For alcohol abuse, (see Table 4) submarine personnel had significantly lower hospitalization rates than surface-ship personnel in each of the five occupational groups; administrative/clerical (RR = .61, $p < .05$), blue collar (RR = .34, $p < .05$), electronic/technical (RR = .52, $p < .05$), medical (RR = .35, $p < .05$), and apprentice personnel (RR = .23, $p < .05$). The hospitalization rate for alcohol abuse across all occupational groups for submariners was less than one-half the rate for surface-ship personnel (RR = .40, $p < .05$).

Table 4. Age-Adjusted Alcohol Abuse Hospitalization Rates per 100,000 Person-Years and Relative Risks Among Submarine and Surface-Ship Personnel by Occupational Group.

	Submarine				Surface-Ship				
		95% Confidence Limits				95% Confidence Limits			Relative[1]
Occupational Group	N	Rate	Lower	Upper	N	Rate	Lower	Upper	Risk
Administrative/ Clerical	89	377.4	305.3	468.0	212	614.3	533.2	707.1	0.61*
Blue Collar	252	235.4	207.6	266.9	707	690.5	640.8	744.4	0.34*
Electronic/ Technical	181	199.8	172.2	231.8	297	384.5	343.0	431.0	0.52*
Medical	24	395.1	253.3	588.7	45	1142.8	833.1	1531.4	0.35*
Apprentice	79	2631.7	2100.1	3289.6	374	11487.2	10327.1	12773.8	0.23*
Total	630	242.1	223.2	262.4	1645	607.3	570.3	646.2	0.40*

[1]Submarine personnel relative to the surface-ship personnel

* $p < .05$

For drug abuse hospitalizations (see Table 5), submarine personnel had a statistically significantly lower rate in the blue collar occupations (RR = .47, $p < .05$). Hospitalization rates for drug abuse across all occupational groups for submariners was about one-half the rate for surface-ship personnel (RR = .52, $p < .05$).

Table 5. Age-Adjusted Drug Abuse Hospitalization Rates per 100,000 Person-Years and Relative Risks Among Submarine and Surface-Ship Personnel by Occupational Group.

	Submarine				Surface-Ship				
			95% Confidence Limits				95% Confidence Limits		Relative[1]
Occupational Group	N	Rate	Lower	Upper	N	Rate	Lower	Upper	Risk
Administrative/ Clerical	11	56.0	27.9	100.2	17	69.0	40.2	110.4	0.81
Blue Collar	26	21.2	13.8	31.2	50	45.4	33.7	59.9	0.47*
Electronic/ Technical	23	27.5	17.4	41.3	24	32.7	21.0	48.7	0.84
Medical	2	64.8	7.8	233.9	-	-	-	-	-
Apprentice	41	538.8	384.7	732.8	123	642.8	535.4	771.4	0.84
Total	103	40.0	32.7	48.8	215	76.8	66.7	88.4	0.52*

[1] Submarine personnel relative to the surface-ship personnel

* $p < .05$

DISCUSSION

Several reasons for lower alcohol and drug abuse among submariners are proposed. First, submariners are subjected to a stringent screening process; submarine school is very difficult and competitive. Also, submariners face

psychiatric screening such as for anxiety and depression-proneness, and stress coping capacity. Psychiatric attrition (4%) consists of 58% neurotic and 27% personality disorders (Weybrew and Noddin, 1979). It has been suggested by Schuckit and Gunderson (1974) that the association between substance abuse and naval job type could be a result of selection factors rather than a function of the job. Jobs that tolerate a higher level of disciplinary problems before separating a man from the service could be expected to have higher rates of substance abuse. Due to the nature of its mission and the potential hazards associated with performance decrement in this environment, the submarine service does not tolerate disciplinary problems, and, therefore, has lower rates of alcohol and drug related hospitalizations. Second, submariners have higher levels of education than surface-ship personnel. In this study, over all occupations, submariners had 12.1 years of school compared to 11.7 for the surface-ship personnel. Among naval personnel, there is a negative linear relationship between education and the incidence of disease and illness (Gunderson, Rahe, and Arthur, 1970). Studies by Schuckit (1976) and Kolb and Gunderson (1981) found higher rates of substance abuse among less-educated navy personnel. The lowest rate of alcohol hospitalizations was among submarine electronic/technical personnel, a group that is one of the most highly-educated in the Navy. Gunderson and Colcord (1982) also found naval personnel in electronic occupations to be among the lowest in hospitalization rates for all illnesses. Third, submariners face severe penalties for substance abuse. Hospitalization for drug abuse results in permanent separation from submarine service. Hospitalization for alcohol abuse usually results in the transfer to surface-ships upon return to duty; therefore, repeat offenders could only occur in the surface-ship personnel and not in submarine personnel.

The present study has some limitations. The data were collected from the Service History and Medical Inpatient files for general epidemiological purposes and not as part of a designed study on occupational factors in substance abuse; therefore, conclusions about causal factors must be made with caution. Also, outpatient data were not available, and hospital admission data may not completely reflect health status, particularly among submarine personnel where long periods of deployment may preclude hospital admission for relatively minor conditions. A study by Nice (1984) found that

the rates of medical evacuations from submarines are among the lowest of all naval ships, suggesting that medical events are treated by available medical personnel.

Studies of substance abuse among naval personnel can make an important contribution to the understanding of substance abuse problems in our society. They allow the opportunity to assess the extent and outcome of substance abuse in a large population of healthy personnel that represents a cross-section of young Americans. Further, the U.S. Navy's standardized medical and service history records make it possible to study the long-term effects of substance abuse on the health and performance of personnel during, in many cases, their entire working career. It would be very difficult, not to mention extremely costly, to find a comparable group for study outside of the Armed Forces.

In summary, when comparing alcohol and other drug abuse hospitalization rates between personnel on submarines and surface-ships for five occupational groups, submarine personnel had lower hospitalization rates. The lower submariner hospitalization rates appear to be associated with submarine selection factors such as the intolerance of disciplinary problems; higher levels of education; severe penalities for substance abuse; and, may be a consequence of such medical practices associated with long periods at sea i.e., the difficulty of medical evacuation from a submarine.

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APPENDIX 1

Naval Enlisted Personnel Rates in each Occupational Group

Numerical Code	Alpha Abbreviation	Available Pay-grades	Occupation (Rate)
Administrative/Clerical			
1400	NC	E5-E9	Navy Counselor
1700	YN	E1-E9	Yeoman
1750	LN	E5-E9	Legalman
1800	PN	E1-E9	Personnelman
1900	DP	E1-E9	Data Processing Technician
2000	SK	E1-E9	Storekeeper
2100	DK	E1-E9	Disbursing Clerk
2200	MS	E1-E9	Mess Management Specialist
2300	IS	E1-E9	Intelligence Specialist
2490	SH	E1-E9	Ship's Serviceman
2600	JO	E1-E9	Journalist
2700	PC	E1-E9	Postal Clerk
Blue Collar			
0100	BM	E1-E9	Boatswain's Mate
0450	OT	E9	Ocean Systems Technician
0500	TM	E1-E9	Torpedoman's Mate (Sub/Surf)
0600	GM	E8-E9	Gunner's Mate
0601	GMM	E1-E7	Gunner's Mate-Missiles
0602	GMT	E1-E9	Gunner's Mate-Technician
0604	GMG	E1-E7	Gunner's Mate-Guns
0810	MT	E1-E7	Missile Technician
0900	MN	E1-E9	Mineman
3700	MM	E1-E9	Machinist's Mate
3800	EN	E1-E9	Engineman
3900	MR	E1-E9	Machinery Repairman
4000	BT	E1-E9	Boiler Technician-at E6 may opt for BR
4020	BR	E6-E9	Boilermaker
4100	EM	E1-E9	Electrician's Mate
4200	IC	E1-E8	Interior Communications Electrician
4300	HT	E1-E9	Hull Maintenance Technician
4400	GS	E8-E9	Gas Turbine System Technician
4600	PM	E1-E7	Patternmaker
4700	ML	E1-E9	Molder
5100	EA	E1-E8	Engineering Aid
5300	CE	E1-E8	Construction Electrician
5410	EO	E1-E8	Equipment Operator
5500	CM	E1-E8	Construction Mechanic
5600	BU	E1-E8	Builder
5700	SW	E1-E8	Steelworker
5800	UT	E1-E9	Utilitiesman

Appendix 1 (Continued)

Blue Collar

6080	AF	E9	Aircraft Maintenance Technician
6180	AV	E9	Avionics Technician
6200	AD	E1-E8	Aviation Machinist's Mate
6206	ADJ	E1-E7	Aviation Machinist's Mate-Jet Engines
6500	AO	E1-E9	Aviation ordnanceman
6520	AQ	E1-E8	Aviation Fire Control Technician
6700	AB	E8-E9	Aviation Boatswain's Mate
6800	AE	E1-E8	Aviation Electrician's Mate
6900	AM	E8	Aviation Structural Mechanic
7000	PR	E1-E9	Aircrew Survival Equipmentman
7300	AK	E1-E9	Aviation Storekeeper
7400	AZ	E1-E9	Aviation Maintenance Administrationman
7500	AS	E6-E9	Aviation Support Equipment Technician

Electronic/Technical

0150	MA	E5-E9	Master-at-Arms
0200	QM	E1-E9	Quartermaster
0250	SM	E1-E9	Signalman
0300	OS	E1-E9	Operations Specialist
0350	EW	E1-E9	Electronics Warfare Technician
0400	ST	E9	Sonar Technician
0401	STG	E1-E8	Sonar Technician-Surface
0404	STS	E1-E8	Sonar Technician-Submarine
0800	FT	E8-E9	Fire Control Technician
0801	FTG	E2-E7	Fire Control Technician-Gun
0802	FTM	E1-E7	Fire Control Technician-Surface Missile
0803	FTB	E1-E7	Fire Control Technician-Ballistic Miss.
1000	ET	E1-E9	Electronics Technician
1001	ETN	E1-E5	Electronics Technician-Communications
1002	ETR	E1-E5	Electronics Technician-Radar
1010	DS	E1-E9	Data Systems Technician
1100	IM	E1-E8	Instrumentman
1200	OM	E1-E8	Opticalman
1500	RM	E1-E9	Radioman
1666	CTI	E1-E9	Cryptologic Technician-Interpretive
6300	AT	E1-E8	Aviation electronics Technician
6310	AX	E1-E8	Antisubmarine Warfare Technician
6400	AW	E1-E9	Aviation ASW Operator (Acoustic/Non-acoustic)
6600	AC	E1-E9	Air Controlman
7100	AG	E1-E9	Aerographer's Mate
7200	TD	E1-E9	Tradesman
7600	PH	E1-E9	Photographer's Mate

Medical

8000	HM	E4-E9	Hospital Corpsman
8300	DT	E4-E9	Dental Technician

Appendix 1 (Continued)

Apprentice

3600	SR,SA,SN	E1-E3	Seaman recruit, Apprentice, Seaman
5000	FR,FA,FN	E1-E3	Fireman Recruit, FN Apprentice, Fireman
6000	CR,CA,CN	E1-E3	Construction Recruit, Const. Apprentice, Constructionman
7800	AR,AA,AN	E1-E3	Airman Recruit, AN Apprentice, Airman

Other

0000			Not Reported
3100	LI	E2-E9	Lithographer
3200	DM	E1-E9	Illustrator-Draftsman
3300	MU	E2-E9	Musician

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(U) This study evaluated alcohol and drug abuse risks associated with U.S. Navy submarine duty by comparing hospitalization rates of submariners with surface-ship personnel for five occupational groups. Occupational groups included administrative/clerical, apprentice, blue collar, electronic/technical, and medical personnel. Occupational groups were compared between ship type using age-adjusted hospitalization rates for alcohol and drug abuse related diagnoses. For alcohol abuse, submarine personnel had significantly lower hospitalization rates than surface-ship personnel for each of the five occupational groups. Hospitalization rate for alcohol abuse across all occupational groups for submariners was less than one-half the rate for surface-ship personnel. For drug abuse hospitalizations, submarine personnel had a significantly lower rate in the blue collar occupations. Hospitalization rate for drug abuse across all occupational groups for submariners was about one-half the rate for surface-ship personnel. Reasons for lower alcohol and drug abuse among submariners may be stringent screening, higher levels of education, and severe penalties for substance abuse for submariners.

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